Analysing Micro-Innovation Processes: Universities and Enterprises Collaboration

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Abstract
Purpose: This paper discusses one form of innovation work in the area of human technology and its research at universities with The focus is on how to get swiftly advancing basic research knowledge quickly into product development processes.

Design/methodology/approach: The paper discusses a innovation improvement model.

Findings: The industrial feedback demonstrates that the innovation improvement model works well in organizing the implementation of basic research into product development

Originality: The innovation cycle is new in the area of human technology for conveying basic research findings into industrial innovation process.

Paper type: Conceptual-empirical

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Introduction

We divide innovation processes into two types. National economy level innovation processes can be called macro-innovation processes. However, below these financing, resource sharing and social engineering processes one can find such simple phenomena as innovative thinking, information flow to innovative persons, and the flow of critical information to critical actors. The latter type of processes we call microinnovation processes.

The role of universities in innovation management has been widely acknowledged and researched (Etzkovitz 2003, Goldfarb and Henreksson 2003, Sutz 2000, Zucker and Darby 1996). Nevertheless, the creation of concrete innovation mechanisms offers many challenges and development possibilities. Especially important to work with a focus on micro-level driving mechanisms that provide concrete contents for innovation improvement, because the success of macro-level, government-driven operations is ultimately dependent upon how the actual invention innovation processes succeed.

Macro-level innovation improvement operations and policies have been intensively studied and developed during recent decades and we have solid understanding of these mechanisms (Dieren, Stoneman Toivanen and Wolters 1999, Sundbo 2003). However, the micro-level mechanisms—the concrete practices fostering innovation in generating thinking–often focus on various issues typical to personnel management and the development of organizational competencies (Cantell and Fai 1999, Ekvall 1996, Eisenberg, Fasolo and Davis-LaMastro 1990, Pitt and Clarke 1999, Ritter and Gemünden 2003).

Social innovation capacity depends significantly on basic scientific research. Such foundational research breakthroughs and ideas spread into social innovation capital and enable product developers to find new ideas to be used in innovation development. Therefore, basic research knowledge plays a crucially important role within the full social innovation concept. As a result, it should be possible to improve innovation processes by improving the flow of basic research knowledge from universities to enterprise product development processes. The challenge is finding a suitable mechanism for this transfer.

Our earlier experiences have shown that mere lectures are relatively unsuccessful in furthering the integration of basic research knowledge into enterprise product development systems. Product designers, for the most part, do not derive much information in this form of information dissemination. On the other hand, these lectures do allow for explaining basic notions and ideas so that the enterprises can form an idea about what was happening in basic science and can grasp the basic concepts. Nevertheless, a lack of connection between the ideas and understanding and the application of such was obvious What seemed to be needed was a more practical means for conveying information and envisioning applicability within design development. This resulted in the model for information transfer, in which lectures, the media, and other general information methods were applied to deliver an overview of the most important develop-

ments in basic scientific research, which was then followed by workshop practices where academics and enterprise personnel actively participated in the process of exploring the practical uses of basic research knowledge for product development potential.

Human Technology: The Research Area

Human–device interaction is an increasingly important factor for new product development. It has played a decisive role in many important ICT developments, such as the growth in Nokia or Razr sales. One can no longer ignore the significance of the users and the user interaction process when conceiving and enhancing product innovation processes.

Basic research in this area has grown substantially since the 1980s While this research has focused primarily on human–computer interaction, it applies equally, and more frequently nowadays to mobile devices and mobility issues because of the increase in mobile devices. This means that basic research in the field can quickly enhance product progress. Yet, it is well known that the use of the basic research ideas in industry is not always optimal (Carroll 1997).

The field of human–system interaction is new but has produced already a substantial amount of relevant research knowledge. The challenge is how this knowledge can be conveyed into active product development within enterprises. University research in this field typically does not meet readily the needs of practical work in enterprises. Therefore, a new type of innovation thinking is required.

Human–system interaction is a specifically challenging area for the advancement of innovations. It must be based on human research, i.e., on psychology, ergonomics, social psychology and sociology. Product designers seldom are specialists in these human sciences fields and they rarely have more than a rudimentary understanding of appropriate methods or particularly relevant theoretical knowledge required for solving user problems. Secondly, because user interaction design is a very complicated and challenging field, with numerous complex problems, it takes time for developers to master such knowledge and skills.

Innovation enhancing procedure allowed us to address both the challenge of making significant research information known to enterprises, and the challenge to help them address the specific theoretical and research requirements regarding users. As a result, basic knowledge in the form of targeted state-of-the-art lectures were provided initially, and were followed with workshop processes that allowed for teaching and discussion of the theories and practices of user research in a detailed manner.

Research

We pursued an action research perspective because it seemed to be the most logical manner when the goal was to develop micro-level innovation mechanisms (for the application of action research in management operations see Coghlan and Coghlan 2002). This approach proved most practical in investigating management system designs because it allowed direct testing of how well the designed mechanisms work, as well as to identify the approach's strengths and weaknesses. In a way, action research allows analogical iterative generation and testing processes to engineering design for micro innovations systems design.

Innovation procedure was designed for conveying basic research knowledge into product development processes. The goal was to eliminate obstacles that keep university research knowledge from being incorporated into the practical product development processes. The fundamental concept of the procedure was to use general lectures, as well as the media, to disseminate interest and the basic research knowledge to product development practitioners. This was then followed by an active and collaborative workshop-type schema with representatives of the enterprises. The latter stage allowed researchers to guide product designers in a hands-on manner to address concrete issues related to transforming basic research into product concepts. This latter process has been deemed a useful procedure by the participating product developers.

Empirical research on the two-stage procedure was conducted. In the first stage of the research we investigated how well enterprises accepted the idea of model.

Empirical Results

Three projects that reflected the concretized vision of the model to facilitate the transfer of basic research into product development were conducted and evaluated. Each had a different focus and each provided essential findings to enhance the concept of the model. Each project is described briefly here, and more fully to follow.

The first project, the Moitek-project, aimed to explore the process of modeling and adapting the human technology research process. It ran from August 2004 until December 2005. Analysis of this project identified the elements of research dissemination and the roles of partners in the innovations cycle.

The second project was the Innovation Cycle (Innokehä) project. Findings demonstrated the value of the process of knowledge dissemination. The first level operated within general information forums, where the goal was to provide general information about basic and applied science research, with the flow of knowledge from the universities to enterprises. The second level involved collaborative projects with enterprises. The primary emphasis of this project was a seminar format to deliver information.

The third project, the Käytech project, was empirical study to concrete collaborative projects with enterprises. This project proved to be effective in raising awareness of and knowledge about the research activities of universities as well as improving the collaboration between universities and enterprises. This project's primary emphasis was the workshops as a means of underscoring knowledge transfer.

The enterprises involved in these projects were primarily drawn from a group of enterprises that need human–technology knowledge in their product development. Such companies within the greater Jyväskylä district total between 20–30 enterprises, but two of them are world leaders in their technology fields.

Background of the Empirical Study

Moitek Project: Modeling and Adapting Human Technology (2004–2005)
This project was carried out within three medium-sized municipal regions in Finland. The towns and their regions of Pori, Jyväskylä, and Tampere participated.

The starting point for the project was the know-how of the Human Technologies in these regions. The objective of the project was that the persons of the companies and other organizations are able to use new technologies and innovations. The objective was the networking between research and business. As part of the project, a study was made of the expertise of the technology, as well as the strengths and best practices within these regions. On the basis of this report, models were created for developing of these regions.

The project supported the developing of technologies within these regions based on the systems development models and other materials. For example reports on the Information Society and its factor were the reports and publications of EU Commission.

Main results of the project

1. A report of the technology of the regions, including the know-how of the companies and other organizations there, as well as the development activities and innovation activities related them.
2. A model to develop the knowledge of the Human Technologies in regions
3. Action plans to carry out these models
4. A series of seminars in all three regions in Human Technology
5. A plan of a project of Human Technologies together with the key companies and small and medium-sized companies

Innokehä Project: Innovation Cycle (2005–2007)
The University of Jyväskylä has created a multidisciplinary consortium, comprising various university faculties and international companies, which aims at developing innovative environments and networks within FinlandCurrently, diverse hurdles hinder efficient cooperation between universities and companies. The Innokehä project brought together representatives of these parties in order to define a roadmap that can lead to an optimized exploitation of research results and innovations.

For these purposes, innovation discussion forums, so-called Innoforums, were organized. The Innoforums provided an excellent platform for researchers and company representatives to exchange ideas as well as to determine ways for improved interactions, collaborations, and knowledge-transfer from the university to companies. One element of these discussions focused on the utilization of open source methods to guarantee a maximum range of participation and to facilitate open discussions via the Internet. Hence, a website has been established to provide unrestricted access to research knowledge and an eased method for participants to contribute to ongoing discussions.

In addition to providing discussion platforms, the Innokehä project examined four case studies in which knowledge transfer from the university to companies occurred. The goal was to gain a fuller understanding of these circumstances in which research results and innovation were successfully exploited.

Collaborative partners: University of Jyväskylä and companies such as Metso Paper, Nokia Mobile, ISS, TeliaSonera, TietoEnator Oyj, Midinvest Management Oy

Käytech-Project
The Käytech project (2005-2007) was coordinated by the Agora Human Technology Center in the University of Jyväskylä. In this project, researchers conducted

several usability evaluations with 15 small, midsized, and large companies and organizations, operating primarily in the area of central Finland. The goals of the project were to establish a user psychological research laboratory within the Agora Center and to develop methods of interaction research in close collaboration with key product and service development personnel of the companies. The project's research cases were planned and evaluated together with the participating companies in 84 workshop meetings. In addition, seven public seminars, one from each of the university's faculties, were organized for educating participants on significant research findings.

General Discussion

The role of universities in innovation processes has been long recognized. However, mechanisms for how scientific knowledge, especially basic research, can best be conveyed into product development processes remain important. In this paper, we discussed

An innovation improvement model that is intended to enhance human technology innovations. In this model, universities first offer to enterprises lectures on basic research and the latest developments. After that, the knowledge is elaborated within common workshops and projects based on the concrete product development processes. Empirical knowledge of the reception of the model has been collected and, on these data, the model seems to be acceptable by the industry.

The procedure was quite positively accepted by the participating enterprises. It demonstrated that basic science information in the field of human technology is important to the enterprises. It means also that workshop procedure is a genuine innovation mechanism.

An interesting additional feature of the present action research was its positive influence on and improvement in the university researchers' understanding the field of Human Technology. Workshops also directed the research into more actual problems. Feedback from the researchers point to several benefits they gained from participating in the workshops: experience in workshop methods, experience of the collaboration between academic research and company R&D application, experience with company R&D methods and practices, expanded knowledge of technologies, new skills in applying a wider range of usability methods, improved knowledge of HCI, knowledge of HCI practices and methods within companies, and experience in applying HCI knowledge.

Innovation cycle describes the flow of innovation-critical knowledge within the innovation model. Basic science leads to applied research, which leads to research and development. In turn, the resulting product development influences the direction of basic research.

Basic research follows the basic logic of science. It is a long chain of individual inventions and observations (Saariluoma 1997). Solving fundamental problems opens the possibilities to ask new questions and seek solutions to them. This movement is controlled by basic science's own logic. However, possible directions for developing basic science are quite diverse and therefore interaction with industrial innovation process is important in developing strategies for basic science.

The innovation cycle thus has a feedback loop. A good historical example of industry-inspired basic research is Pasteur's' investigation of spoiling wine, thus discovering the role of microbes in wine processing, which in turn resulted in the development of a new scientific field: microbiology.

It was not only collaborative business partners which have got something special from workshops for their business, also researchers got lot of practical experience and knowledge from those workshops. The researchers listed they got more:

- experience of workshop methods
- experience of academic research and company R&D co-operation
- experience of company R&D working methods
- knowledge of technology
- skills to apply wide range of usability methods
- knowledge of HCI
- knowledge of HCI practical methods in companies
- experience of applying HCI knowledge

In reviewing the outcome of this knowledge transfer project, we can see that the model provides a solution to the challenges of developing micro-level innovation mechanisms in the area of human–technology for conveying basic research knowledge to enterprises. Overall, this type of action research enables innovation researchers to design new types of micro-level innovation mechanisms as well as to design optimal modes for them.

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